

**MCEETYA ICT in Schools Taskforce**

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**BANDWIDTH WORKING GROUP  
REPORT MARCH 2002**

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## 1. BACKGROUND

### 1.1 BANDWIDTH IN THE SCHOOL SECTOR

Australian Education Ministers have adopted *Learning in an Online World*: as the *school education action plan for the information economy*. One of the three priorities identified is **bandwidth**:

*Sufficient bandwidth must be available at affordable rates, to enable all schools to integrate online services into their curriculum practice.*

The ICT in Schools Taskforce work plan includes provide strategic advice to MCEETYA on bandwidth needs for the school sector. A submission has been forwarded to AESOC to facilitate the development of a policy discussion paper for the meeting of ministers in July 2002 (Attachment A)

In addressing *bandwidth*, the MCEETYA ICT in Schools Taskforce recognises the inter-relationship between the three distinct components to telecommunications services provided to schools.

1. Data carriage
2. Traffic content
3. Technical management

Schools and education systems generally face different cost issues for each component, and there is variation in purchasing agreements and market dynamics.

*Data carriage* primarily concerns the “pipes” or carriage services that carry data to and from schools. Data carriage is generally through a cable utilising technology such as ISDN or ADSL. However, wireless technologies including satellite services are also used. Discussions about bandwidth generally refer to the capacity of the data carriage service to schools.

*Traffic content* concerns the actual data being carried to and from the school. Internet access charges are paid to an Internet Service Provider for content accessed from the Internet. These charges are generally separate from the data carriage charges and are often based on the actual number of bytes downloaded.

Other traffic content carried over telecommunications links to schools includes administrative information exchanged with education system central offices and services such as email or video conferencing. This traffic may be within an education system and not involve charges paid to an external Internet Service Provider.

The third component is *technical management*. Hardware and software is required to manage data carriage and content services. Unlike data carriage and content costs, technical management costs are not generally proportional to the capacity of network

links provided to schools. They are related to elements including geographic location, complexity and functionality of services, and age of hardware and software.

The initial work of the MCEETYA ICT in Schools Bandwidth Working Group has been to articulate the current bandwidth provision to states and territories and to consider the bandwidth provision that will be needed as the online learning paradigm is adopted in schools.

## **1.2 MCEETYA RESOLUTION 2001**

The June meeting of MCEETYA 2001 resolved that Council agreed to:

- a) strongly urge the Commonwealth to consider options within the telecommunications legislative and regulatory framework to assist in ensuring bandwidth for school education and training is:
  - commensurate with current and emerging needs of schools;
  - accessible from all parts of Australia, both urban and rural;
  - available at a cost that enables schools to participate in and contribute to the information economy, recognising that States/Territories and non-government school education authorities also have responsibility for information and communications technology infrastructure provision to schools.
  
- b) refer this matter to AESOC bringing their attention to the need for further analysis of the school education sector's telecommunications needs to assist in better understanding the gaps in bandwidth provision and how these might be addressed. This should include an analysis of cross-sectoral developments. The results of this research could be used to inform the National Communications Fund.

## **1.3 BANDWIDTH ADVICE TO AICTEC**

As part of its Business Plan, 2001-2002, AICTEC has undertaken to investigate options relating to the affordability and accessibility of bandwidth and forge strategic partnerships to advocate for access by all educational providers and learners to adequate levels of bandwidth.

AICTEC will actively monitor the supply of, and demand for bandwidth across the education and training sector, including cost factors and international comparisons.

AICTEC will investigate establishing minimum requirements for bandwidth and establishing education and industry standards for equipment configuration (AICTEC: 2001:17)

The MCEETYA ICT in Schools Taskforce is the peak body to provide advice to AICTEC on behalf of the School Sector.

#### 1.4 INTERNATIONAL AND NATIONAL BANDWIDTH TARGETS - NOVEMBER 2001

Few countries have publicly released targets for connectivity. Kelso attributed this reticence to the costs for telecommunications bandwidth and therefore the risks of adhering to targets as fiscally inadvisable. Moreover, target setting presumes the ability to scope the required need for certain bandwidth-consuming applications which may be quite variable or unforeseen in rapidly developing marketplaces. (AICTEC Connectivity Discussion Paper November 2001).

The Canadian National Broadband Taskforce concluded that 1.5mbit/s per individual user is currently required to support connectivity across Canada. The recommendation of the Taskforce was for institutions to have 10Mbit/s (symmetric).

In the UK the government has undertaken to have all schools connected to the internet by 2002 and 20% of all schools to have broadband access by the end of 2001.

Scottish Ministers have made clear their commitment to achieving sufficient bandwidth into all Scotland's schools to allow for the substantial expansion of the use of Internet access, e-mail, data communication and high-quality video interaction – with ISDN 2 established as a minimum standard of connectivity. (ISDN2 supports 128kbps in 2 channels of 64kbps and can be used for 2 simultaneous calls enabling voice and data transmission).

In Oklahoma (United States), OneNet, the State owned network and ASP delivering delivers services to government and education. Through OneNet, schools throughout Oklahoma have Internet 2 access.

In 1999 the following recommendation was put to the Australian Government as part of the Moon Report commissioned by DETYA:

*That, in 1999 MCEETYA set a new National Education Data Standard (NEDS) for the provision of minimum bandwidth for every school and VET teaching location in Australia, of at least 128 Kbps in 2000, 256 Kbps in 2001 and moving to 2Mbps by 2004. Further, that the standard recognises an increased bandwidth requirement for every institution where the number of students exceeds a total of 200”.*

The AICTEC Connectivity Discussion Paper November 2001 asserts that these standards are too low, given new requirements for online learning (including symmetric two-way videoconferencing). Aiming for 10MB would seem to represent a reasonable strategy over the medium term.

ASAP	-	about 1-2MB/s
3-5 years	-	about 10MB/s
5-8 years	-	100 MB

## 1.5 CURRENT BANDWIDTH PROVISION IN AUSTRALIAN STATES AND TERRITORIES

The following table provides a summary of current *bandwidth* provision to government schools in Australian States and territories. The state audit sheets are included as Attachment B. The Independent and Catholic Systems were not able to provide summaries of bandwidth provision, given the diversity in provision between individual schools.

STATE / TERRITORY	SUMMARY OF BANDWIDTH PROVISION	SUMMARY OF PROPOSALS FOR CHANGES TO BANDWIDTH PROVISION
ACT	<ul style="list-style-type: none"> <li>64K ISDN to most schools and 128K ISDN to all colleges with dial up facilities available for a few outlying schools.</li> <li>Provision has been constant over the last two years</li> </ul>	<ul style="list-style-type: none"> <li>Implementing a VDSL WAN that will provide a 2MB/256K link to all schools with &lt; 600 pupils. Schools with &gt; 600 pupils and colleges will be provided with a 5M/512K link.</li> <li>Upgrading of dial up facilities under investigation</li> <li>Alternatives to VDSL being investigated for schools without the VDSL link (considering 64K Onramp service, satellite etc)</li> </ul>
New South Wales	<ul style="list-style-type: none"> <li>64K</li> <li>In the last two years, provision has changed from dial up to WAN</li> </ul>	<ul style="list-style-type: none"> <li>Investigating ways to increase bandwidth</li> </ul>
Northern Territory	<ul style="list-style-type: none"> <li>400K satellite download, 56k uplink</li> <li>Some ISDN uplink up to 128K</li> <li>Increased satellite bandwidth at Belrose from 1M to 2.5 M over the last 12 months</li> </ul>	<ul style="list-style-type: none"> <li>Considering wireless for urban schools and two way satellite for remote schools</li> </ul>
Queensland	<ul style="list-style-type: none"> <li>&lt;800 students 64K</li> <li>&gt;800 students 128K</li> <li>In the last two years, ADSL has been provided to 400 schools</li> <li>Schools with ADSL have the choice of upgrading to 512K or 1.5Mb. Schools with 64K (ISDN) can upgrade to 128K. The cost is met by the school</li> </ul>	<ul style="list-style-type: none"> <li>No plans listed</li> <li>Current Bandwidth provision by schools <ul style="list-style-type: none"> <li>50 schools with Satellite (64K)</li> <li>6 schools with Frame Relay (256K)</li> <li>738 schools with 64k OnRamp2</li> <li>106 schools with 128k OnRamp2</li> <li>430 schools with ADSL (256K)</li> </ul> </li> </ul>

SA	<ul style="list-style-type: none"> <li>• Minimum 128K</li> <li>• Schools &gt; 675 pupils have 256K</li> <li>• 7 sites with 2M</li> <li>• 1 has 1.5 M ADSL</li> <li>• 4 2-way satellite sites</li> <li>• Provision has not changed over the last two years</li> </ul>	<ul style="list-style-type: none"> <li>• Over next two years will be improving quality of services with opportunities for schools to expand on demand (taking advantage of state telecommunications agreement with Telstra with wide-band IP)</li> </ul>												
Tasmania	<ul style="list-style-type: none"> <li>• 148 Schools with 64K ISDN</li> <li>• 30 Schools with 128K ISDN</li> <li>• 15 Schools with 256K ISDN</li> <li>• 8 Schools with 512K ISDN/ADSL</li> <li>• 3 schools with 640K Frame Relay</li> <li>• 3 Schools with 1.5M ADSL</li> <li>• 3 Schools with I stations on dial up connection</li> <li>• Two years ago most schools only had 64K</li> </ul>	<ul style="list-style-type: none"> <li>• Over the next two years it is expected that over 50% of Tasmanian Schools will have from 2M-10M (also managing requirement for higher bandwidth through special caches and other network management tools).</li> </ul>												
Victoria	<ul style="list-style-type: none"> <li>• minimum 64K</li> <li>• &gt;500 pupils 128K</li> <li>• &gt;1500 pupils 256K</li> <li>• Guideline is 64K per 64 network connected devices.</li> <li>• Minimal changes over the last two years</li> </ul> <p>1</p>	<ul style="list-style-type: none"> <li>• No plans listed</li> </ul> <p>Current Bandwidth to schools: ,</p> <table border="0"> <tr> <td>279 schools with 64kbps,</td> <td>310 schools with 128kps</td> </tr> <tr> <td>33 schools with 192kbps.</td> <td>18 schools with 256kps,</td> </tr> <tr> <td>8 schools with 320 kbps,</td> <td>1 school with 384kps,</td> </tr> <tr> <td>4 schools with 448 kbps,</td> <td>17 schools with 512 kbps,</td> </tr> <tr> <td>7 schools with 512kbps,</td> <td>4 schools with 768nkbps,</td> </tr> <tr> <td>3 schools with 1024 kbps</td> <td></td> </tr> </table>	279 schools with 64kbps,	310 schools with 128kps	33 schools with 192kbps.	18 schools with 256kps,	8 schools with 320 kbps,	1 school with 384kps,	4 schools with 448 kbps,	17 schools with 512 kbps,	7 schools with 512kbps,	4 schools with 768nkbps,	3 schools with 1024 kbps	
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WA	<ul style="list-style-type: none"> <li>• Majority 64K dial on demand</li> <li>• PSTN dial on demand for remainder</li> <li>• Some very remote schools not connected</li> <li>• Provision has not changed over the last two years</li> </ul>	<p>In the process of rolling out:</p> <ul style="list-style-type: none"> <li>• 10M to every metro school</li> <li>• 2M to every regional high school</li> <li>• 512K to every regional primary school</li> <li>• 2 way satellite (5.9M inbound shared and 3x128K outbound shared) to 39 remote schools</li> </ul>												

## **2 INCREASED BANDWIDTH IS A CRITICAL PEDAGOGICAL ISSUE FOR THE SCHOOL SECTOR**

### **2.1 ACCESS AND EQUITY**

The DETYA report *Real Time – Computers, Change and Schooling* (1999) suggested that students who have less access to computers and quality computer programs at home and at school are likely to be educationally disadvantaged. From an equity stance, it could be argued that students working in government schools should have as a minimum, the same access to bandwidth as those students whose families can afford internet access from home. In metropolitan areas this would be at least 50kbps.

The lack of access to sufficient bandwidth compounds the education disadvantage for students who live in rural and remote areas. States and territories are working individually to resolve issues relating to the *black hole*. There is an immediate need for a national approach to provide adequate telecommunication services to rural and remote communities.

### **2.2 ONLINE LEARNING**

Education systems are incorporating online learning as an integral part of class teaching and learning programs. Distance education programs are increasingly being delivered online. The state and territory audits highlight the critical importance of adequate bandwidth to the implementation of online learning. Lack of bandwidth is limiting the implementation of online learning. It is also generally agreed that demand for bandwidth increases exponentially as online learning is implemented.

2.2.1 The *Tasmanian Case Study* (Attachment B) examined the extent to which schools were using the bandwidth that had been allocated to them. The study examined the graph of activity for each school for a week long period. The graph showed that currently, in the early stages of state implementation of online learning, 58% of schools do not have adequate bandwidth:

- 8% of schools were grossly under-utilizing bandwidth available to them. (for many of these schools this was an abnormal week)
- 34% of schools had a reasonable bandwidth for the use they were making.
- 34% of schools needed higher bandwidth. A number of times each day the system would be very slow.
- 21% of schools badly needed higher bandwidth. For most of the days there was no period where bandwidth wasn't being fully utilised which means that it would appear slow at all times.
- 3% of schools were a stage worse than "badly needing higher bandwidth". It is likely that these schools would be unable to use the bandwidth because of the serious contention issues.

The Centre For Excellence in Online Learning worked with the Information Management Branch to develop a framework to identify the bandwidth requirements to support online pedagogy in a school of 400 students. This framework, underpinned by a set of articulated assumptions was mathematically modelled. In this model for, **a school of 400 students, advanced in their initial implementation of online learning, would require a bandwidth provision of 3mbps in 2002.** (Attachment C)

2.2.2 The following extract from *The Queensland Case Study – the Virtual Schooling Service* (Attachment B) highlights pedagogical issues related delivering distance education online with limited bandwidth provision.

In response to Education Queensland’s New Technologies Project (March 1999) the Virtual Schooling Service (VSS) was established to develop online services and flexible curriculum delivery options to maximise the educational benefits of Education Queensland’s considerable investment in network infrastructure.

The VSS aims to exploit this potential to enhance the subject choice available to senior secondary learners via use of an interactive online environment. The students targeted are those in metropolitan, and rural and remote areas who have limited subject choice at their current school due to school size or location.

The impact of VSS delivery on school bandwidth is significant. For example, ideally each student would be allocated a computer for the synchronous lessons to ensure they can have hands-on interaction with the materials the VSS teachers are presenting. Feedback from students indicated this is their desired scenario and satisfaction levels increase when it can be arranged. However, because of the increased demand on the school’s EdNet connection and the internal school network when the number of computers online increases, VSS teachers have found that they often need to limit the number of computers online simultaneously. It is also found that as network saturation occurs, students often experience ‘drop-outs’ from the data conference and need to rejoin the lesson. Since the voice component is carried by teleconference, they are still able to maintain voice contact with their teacher.

The issue of increasing bandwidth is complex. It is often not just a case of increasing the capacity of the ‘pipe’ to the school. In a number of instances, the bandwidth to the school has been increased and it has not resulted in any significant improvement in delivery. In other cases, the increase bandwidth has been immediately consumed due to poor management practices in the school (this is particularly so in lunch times where unsupervised ‘surfing’ is permitted).

Providing increased bandwidth to schools is one of a complex inter-related set of issues. Other factors which must be considered include:

- the organisation of the school’s local area network infrastructure;
- compliance of the local area network with organisational standards;
- management practices in place at the school for effective utilisation of networking resources
- effective training and professional development for network managers and

### 3 BANDWIDTH WORKING GROUP RESPONSE TO RECOMMENDATIONS PRESENTED TO THE NOVEMBER MEETING OF THE ICT IN SCHOOLS TASKFORCE

	<b>Recommendations to the November ICT in Schools Meeting</b>	<b>Bandwidth Working Group Recommendations</b>
1	<p>The following Bandwidth Benchmark Targets benchmarks be endorsed for the Australian School Sector</p> <p>a) 10kps – 2003 b) 100kbps – 2006</p>	<p>That a Bandwidth Target of 3 mbps be endorsed as an indicative target for 2003 for an Australian school of 400 students. (Endorsed following discussion of the model presented by Max Gentle – Appendix D)</p> <p>This target will be scaleable, increasing and decreasing to meet the level of implementation of online learning that is occurring in systems and schools.</p> <p>A revised bandwidth target statement to be forwarded to the MCEETYA ICT in Schools Taskforce and to AICTEC.</p>
2	<p>A working group of the taskforce be established to undertake an ongoing program to monitor emerging bandwidth needs and costs.</p>	<p>There needs to be alignment between the MCETYA ICT in Schools Taskforce, the Bandwidth Working Group and the AICTEC Bandwidth Working Group.</p>
2a	<p>Monitoring the emerging system and school needs based on the adoption of the online learning paradigm is adopted in schools.</p>	<p>State audits have been undertaken. These are included at Attachment B. The Tasmanian Case Study Paper is an initial attempt to link bandwidth targets to educational needs.</p> <p>Quantifying the amount of bandwidth needed to run learning and administrative functions five years out is difficult given the rapidly evolving paradigm of online learning.</p>

2b	In conjunction with other task force working groups, identifying the key software applications being adopted by Australian schools and highlighting the telecommunications implications of these applications	The Learning Architectures Group is progressing the work on identifying key software applications. When complete, the bandwidth group can highlight the telecommunication aspects of these applications
2c	<p>Pooling telecommunications usage statistics from schools systems including volume and type of traffic to produce national summaries.</p> <p>Pooling broad information on telecommunications expenditure by school systems to identify per student costs under the headings of data carriage, traffic content and technical management.</p>	<p>Pooling of usage statistics may be of limited value in determining emerging needs for a new paradigm.</p> <p>There are sensitivities related to sharing telecommunications costs. This issue will be considered at the March meeting of the taskforce</p>
3	National collaboration on the provision of connectivity to rural and remote Australia	This is an issue for consideration at the March meeting of the ICT in Schools Taskforce.

Recommendations presented to the November meeting for discussion are included as Attachment D.

#### **4      WAYS FORWARD FOR THE MCEETYA ICT IN SCHOOLS TASKFORCE**

- There is currently no commonly accepted statement or formula that succinctly defines the telecommunication needs of Australian schools. This is in contrast to the desktop computer infrastructure where one computer for every five students is a commonly quoted benchmark. A comprehensive statement of bandwidth needs for schools needs to include data carriage benchmarks, and a consideration of traffic content and technical management issues.

States are responding to bandwidth issues in various ways. A set of principles needs to be developed to underpin the national debate.

This process will start in a workshop session at the March meeting of the taskforce.

- A Bandwidth Framework for the Australian School Education Sector, that articulates pedagogical assumptions and that could be mathematically modelled be developed to guide the bandwidth debate. This work will build on the initial work that Max Gentle undertook for the Bandwidth Working Group and be informed by the principles articulated by the Taskforce.
- A submission for funding for a consultancy to develop a School Sector policy was distributed to taskforce members in February. This submission has been forwarded to AESOC for consideration for funding. This consultancy could support the development of the set of principles and the development of a framework for bandwidth provision.
- As the peak body representing the school sector, the ICT in Schools Taskforce is in the position to influence the development of national policy for connectivity at affordable rates for the school education sector.

As the peak body the taskforce is also positioned to meet with and influence telecommunication suppliers.

The workshop session at the March meeting will explore ways to take these issues forward.

- The ICT in Schools Taskforce needs to identify and prioritise areas within the telecommunications area, where they see advantage in sharing and working collaboratively.

This will be a topic for exploration at the March meeting of the taskforce.

**PROJECT: BANDWIDTH**

<b>Schools Bandwidth Policy Paper for Discussion by Ministers</b>	<b>MARCH 2002 – JUNE 2002</b>	<b>\$30 000</b>
<b>MCEETYA RESOLUTIONS</b>	<p><b>MCEETYA Ministers Joint Statement on Education and Training in the Information Economy</b></p> <p>Ministers agreed that the following are the highest priorities for cooperation in 2001-2003:</p> <ul style="list-style-type: none"> <li>• providing effective and affordable access to the Internet for all learners regardless of their geographic location</li> </ul> <p><b>Council agreed at the MCEETYA meeting 2001 to:</b></p> <p>a) strongly urge the Commonwealth to consider options within the telecommunications legislative and regulatory framework to assist in ensuring bandwidth for school education and training is:</p> <ul style="list-style-type: none"> <li>• commensurate with the current and emerging needs of schools</li> <li>• accessible from all parts of Australia, both urban and rural</li> <li>• available at a cost that enables schools to participate in and contribute to the information economy, recognising that States/Territories and non government school education authorities also have responsibility for information and communication technology infrastructure to schools.</li> </ul> <p><b>Ministers endorsed <i>Learning in an Online World: school education plan for the information economy as the strategic plan for the school sector at the March MCEETYA meeting 2000.</i> Within the five action areas the highest priorities are:</b></p> <ul style="list-style-type: none"> <li>• <b>bandwidth:</b> sufficient bandwidth must be available at affordable rates, to enable all schools to integrate online services into their curriculum practice.</li> </ul>	

<p><b>TERMS OF REFERENCE</b></p>	<ul style="list-style-type: none"> <li>• provide strategic advice to the Australian Education System Official Committee (AESOC) and MCEETYA on the use of information and communication technologies to support teaching and learning</li> <li>• advance the use of information and communication technologies that meet the needs of education</li> <li>• provide a forum for Australian education representatives to share information and advance collaborative initiatives in the use of information and communications technologies in education</li> </ul>
<p><b>BACKGROUND</b></p>	<p>The provision of adequate bandwidth to schools in Australia in general, and addressing access to bandwidth in rural and remote Australia are significant education and political issues.</p> <ul style="list-style-type: none"> <li>• Adequate bandwidth provision to the school sector is attracting increased media attention.</li> <li>• DEST has commissioned a number of significant national papers on Bandwidth in the training and education sectors The ICTST facilitated a national forum (September 2001) that identified bandwidth issues and attempted to address targets for the schools sector. A working party of the taskforce is progressing this work.</li> <li>• There is a need for a consultancy to bring together this work into a strategic policy discussion paper for Ministers as a platform for influencing telecommunications policy, both through the school sector and through the AICTEC policy statement (cross sector)</li> </ul>
<p><b>PROCESS</b></p>	<p><b>March 2002 – June 2002</b></p> <ul style="list-style-type: none"> <li>• Commission the project for the Bandwidth Policy Statement overseen by a steering committee of the ICT in Schools Taskforce in March 2002</li> <li>• Consultation April/May 2002</li> <li>• Report finalised May/June 2002</li> <li>• Bandwidth Policy Discussion endorsed by AESOC June 2002</li> <li>• Bandwidth Policy Discussion Paper submitted to MCEETYA</li> </ul>
<p><b>OUTCOMES</b></p>	<ul style="list-style-type: none"> <li>• Bandwidth Policy Paper for discussion by Ministers at the July 2002 meeting of MCEETYA</li> </ul>



## MCEETYA ICT IN SCHOOLS TASKFORCE

### BANDWIDTH SURVEY

**JURISDICTION:**

**AUSTRALIAN CAPITAL TERRITORY**

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#### SECTION A: PROCUREMENT ARRANGEMENTS

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How do your schools connect with each other?

VIA THE INTERNET USING AN ISP

via a Wide Area Network directly

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#### SECTION B DESCRIPTION OF HOW BANDWIDTH IS ARRANGED FOR YOUR SCHOOLS

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B1 What is your standard bandwidth provision to schools? (eg 64 k, 2mg)

**64K ISDN to most schools**

**128K ISDN to all Colleges (8)**

B2 How do you determine what bandwidth is provided for schools?  
(Please provide details where there is a different level of bandwidth allocation across schools)

**64 K was affordable and felt to be adequate for what began as an administrative network. Colleges were considered likely to need higher for Internet access as well as administrative functions.**

B3 What is your provision for rural and remote schools?

**Not an issue for us except for a few outlying schools. A dial up facility is provided.**

B4 To what extent have you changed your bandwidth provision to schools over the last two years?

**No change.**

B5 What plans do you have to extend connectivity to schools over the next two years.

**Implementing a VDSL WAN that will provide a 2MB/256K link to all schools with fewer than 600 pupils. Schools with more than 600 pupils and all colleges will be provided with a 5MB/512K link.**

**Upgrading of dial up facilities is being investigated.**

**Alternatives for schools not connected by the VDSL link being investigated, will consider 64K Onramp service, satellite and any other cost effective options we can discover.**

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**SECTION C MANAGEMENT ARRANGEMENTS**

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- C1 Describe the tools that schools have to manage connections and traffic.  
**Schools have management functions available to them for our Internet service, including the ability to restrict downloads to individuals, groups and to the school. They have no tools for managing (reporting and analysing) traffic**
- C2 What policies that you have in place to manage usage?  
For example, do you control times of internet use?  
**These are individual school decisions. The Internet management function can allow downloads to be restricted.**
- C3 Do schools have to pay for connection and usage costs directly, or is this centrally provided and funded?  
**The department pays lines costs and all central infrastructure costs. Schools pay a fee for an Internet domain and all download costs.**
- C4 What caching arrangements do you have in place at the school level and centrally?  
**Schools are being encouraged to implement a proxy server that performs local caching, approximately 40% have done so. There is a central 50 GB cache and a cache at the My internet site as well.**

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**SECTION D ONLINE LEARNING**

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- D1 To what extent is Online Learning is occurring over the network?  
**Insufficient bandwidth to allow this to happen in the past but it is beginning to happen with teachers being provided with resources online.**
- D2 What work is your state doing to further the appropriate use of technology in schools?  
**Upgrading WAN links; Upgrading and replacing administration servers, routers and switches; Identifying opportunities for other infrastructure upgrades that will allow a consistent approach to be adopted by all schools.**

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**SECTION E      CONTACT OFFICER**

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**MCEETYA ICT IN SCHOOLS TASKFORCE**

**BANDWIDTH SURVEY**

**JURISDICTION:**

**NEW SOUTH WALES**

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**SECTION A: PROCUREMENT ARRANGEMENTS**

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How do your schools connect with each other?

**VIA THE INTERNET USING AN ISP**

via a Wide Area Network directly

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**SECTION B DESCRIPTION OF HOW BANDWIDTH IS ARRANGED FOR YOUR SCHOOLS**

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- B1 What is your standard bandwidth provision to schools? (eg 64 k, 2mg)  
**64kps**
- B2 How do you determine what bandwidth is provided for schools?  
(Please provide details where there is a different level of bandwidth allocation across schools)  
**All schools have the same bandwidth**
- B3 What is your provision for rural and remote schools?  
**As above - 64kps – satellite to 165 sites. Shared 4mb**
- B4 To what extent have you changed your bandwidth provision to schools over the last two years?  
**Provision has changed from dial up access to WAN**
- B5 What plans do you have to extend connectivity to schools over the next two years.  
**All schools are connected. We are investigating ways in which to increase their capacity.**

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**SECTION C MANAGEMENT ARRANGEMENTS**

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- C1 Describe the tools that schools have to manage connections and traffic.  
**Able to see traffic. Future ability to block sites locally.**

- C2 What policies that you have in place to manage usage?  
For example, do you control times of internet use?  
**The Department has an Internet Usage Policy. The policy does not limit internet use times .**
- C3 Do schools have to pay for connection and usage costs directly, or is this centrally provided and funded?  
**Internet connection and usage costs are provided and funded centrally.**
- C4 What caching arrangements do you have in place at the school level and centrally?  
**Central cache facilities operate.  
Local cache in high usage sites is being implemented.**

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**SECTION D ONLINE LEARNING**

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- D1 To what extent is Online Learning is occurring over the network?  
**The extent of online learning is currently limited due to restrictions in the availability of appropriate bandwidth.**
- D2 What work is your state doing to further the appropriate use of technology in schools?  
**NSW has a number of strategies in place to enhance the use of technology in classrooms across all curriculum areas. These strategies include:**
- The linking of all schools to the Internet.
  - Major initiatives in the provision of computers to schools for teaching and learning.
  - An extensive professional development commitment for staff to support the use of technology in schools.
  - The introduction of the Computer Skills Assessment for students in Year 6.
  - Participation in the national SOCCI initiative which will provide access to an extensive range of resources.

NSW is making a significant commitment to support the use of technology in schools. While essential infrastructure such as equipment and professional development is in place, the potential of online learning initiatives will be restricted by the availability of suitable bandwidth.

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**MCETYA ICT IN SCHOOLS TASKFORCE**

**BANDWIDTH SURVEY**

**JURISDICTION:**

**NORTHERN TERRITORY**

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**SECTION A: PROCUREMENT ARRANGEMENTS**

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How do your schools connect with each other?

**VIA THE INTERNET USING AN ISP**

via a Wide Area Network directly

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**SECTION B DESCRIPTION OF HOW BANDWIDTH IS ARRANGED FOR YOUR SCHOOLS**

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- B1 What is your standard bandwidth provision to schools? (eg 64 k, 2mg)  
**400k satellite download, 56k uplink, some ISDN uplink up to 128K**
- B2 How do you determine what bandwidth is provided for schools?  
 (Please provide details where there is a different level of bandwidth allocation across schools)  
**Some allocation out to all schools**
- B3 What is your provision for rural and remote schools?  
**Satellite. Same as urban schools**
- B4 To what extent have you changed your bandwidth provision to schools over the last two years?  
**Increased satellite bandwidth at Belrose from 1mb yo 2.5mb over the last 12 months.**
- B5 What plans do you have to extend connectivity to schools over the next two years.  
**Considering wireless for urban schools and 2 way satellite for remote.**

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**SECTION C MANAGEMENT ARRANGEMENTS**

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- C1 Describe the tools that schools have to manage connections and traffic.  
**Outsourced arrangement with Optus**

- C2 What policies that you have in place to manage usage?  
For example, do you control times of internet use?  
**Policies currently in development**
- C3 Do schools have to pay for connection and usage costs directly, or is this centrally provided and funded funded?  
**Centrally provided and funded**
- C4 What caching arrangements do you have in place at the school level and centrally?  
**Squid Pra??? at each of 185 schools**

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**SECTION D ONLINE LEARNING**

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- D1 To what extent is Online Learning is occurring over the network?  
**Integral part for teacher development**
- D2 What work is your state doing to further the appropriate use of technology in schools?  
**Providing teacher development and central repository of tools**

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**SECTION E CONTACT OFFICER**

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## MCEETYA ICT in Schools Taskforce

### Bandwidth Survey

**JURISDICTION:**

**EDUCATION QUEENSLAND**

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#### SECTION A: PROCUREMENT ARRANGEMENTS

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How do your schools connect with each other?

VIA THE INTERNET USING AN ISP

via a Wide Area Network directly

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#### SECTION B DESCRIPTION OF HOW BANDWIDTH IS ARRANGED FOR YOUR SCHOOLS

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- B1 What is your standard bandwidth provision to schools? (eg 64 K, 2MG)  
**Schools with an enrolment up to 799 students are provided 64K and schools with an enrolment of 800 and over are provided with 128K.**
- B2 How do you determine what bandwidth is provided for schools?  
 (Please provide details where there is a different level of bandwidth allocation across schools)  
**The allocation is based on school enrolments.**
- B3 What is your provision for rural and remote schools?  
**Rural and remote schools are treated the same as metropolitan and regional schools and provision is based on enrolment.**
- B4 To what extent have you changed your bandwidth provision to schools over the last two years?  
**ADSL has been provided to 400 schools in SE Qld and Townsville. By the end of March, 2002 a further 94 schools will be provided ADSL.**
- B5 What plans do you have to extend connectivity to schools over the next two years.  
**All schools are connected.**

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#### SECTION C MANAGEMENT ARRANGEMENTS

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- C1 Describe the tools that schools have to manage connections and traffic.  
**SINA tools are provided.**

- C2 What policies that you have in place to manage usage?  
For example, do you control times of internet use?

**This responsibility rests with individual schools. There is a HR policy, “Staff Intranet, Internet and Electronic Mail Usage Policy” which applies to all EQ staff. There is also a student policy, “Internet – Student Usage”. The roles and objectives of this policy is to ensure that Principals take appropriate measures to:**

- (a) ensure teachers, students, and parents or guardians are aware of the risks and benefits associated with the usage of Internet services, and the measures in place to minimise these risks;**
- (b) develop Intranet, Internet and Email Usage guidelines that apply to their school;**
- (c) obtain from parents or guardians their written agreement to the student accessing Internet services under the conditions set by the school. (A sample Internet Access Agreement is provided.); and**
- (d) prepare students to cope with unanticipated access to such materials or people.**

- C3 Do schools have to pay for connection and usage costs directly, or is this centrally provided and funded?

**All schools pay a monthly access fee and for their download usage. These accounts are forwarded on a monthly basis.**

- C4 What caching arrangements do you have in place at the school level and centrally?

**Approximately 400 schools have installed their own proxy server. There are also proxy servers at the centre of the network, which is managed by Telstra.**

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#### SECTION D ONLINE LEARNING

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- D1 To what extent is Online Learning is occurring over the network?

**The major initiative is the Virtual Schooling Service (VSS) and a Case Study of this has been attached to this survey. Other online learning initiatives include the following:**

- **The Learning Place:** This will be launched in April, 2002 and will provide an interface to the EQ e-learning platform, Blackboard 5. It will provide an interactive range of flexible communication tools for all EQ staff and students and build and strengthen professionalism by enabling the development of online learning communities.
- **The Digital Resource Centre** The DRC is the key access point for EQ curriculum information. It provides storage for online access to curriculum information and resources for EQ schools through the EQ Internet site, “Curriculum Exchange”. It also provides storage for and access to resources

to support professional activities of teachers through the EQ Internet site, “Professional Exchange”. It streamlines the storage and delivery of curriculum information and resources to EQ schools and is a distributed system which provides a central access point to information stored on several EQ web servers.

- **Distance Education:** AccessEd develops the traditional student lesson materials (print, audio, video, kit, etc.) for all school of distance education students. They also are being provided in hard copy format, and also electronically on CD-ROM to School of Distance Education teachers who can then choose how they individualise the material, and how they deliver lessons to the students in their care. AccessEd is also producing small numbers of resources designed purely for the electronic environment which supplement the basic course.

D2 What work is your state doing to further the appropriate use of technology in schools?

- **Professional Development:** Eight Learning and Development Centres for Technology provide localised and sustainable professional development for teachers. A professional development continua for learning technology has been released (in draft form) to provide learning scaffolds for teachers. AccessED provides extensive training opportunities for internet management software and general internet topics.
- **Funding:** Schools receive regular funding to maintain, upgrade and repair curriculum workstations. Schools also receive technical support funding for curriculum workstations.
- **Partnerships:** A range of awards, partnerships and ‘Centres of Excellence’ recognise and promote effective use of ICT in schools.
- **Software:** A curriculum Standard Operating Environment (SOE) is being introduced to a range of schools to streamline installation and technical support.

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**SECTION E CONTACT OFFICER**

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**SECTION F CASE STUDY**

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### **Virtual Schooling Service**

In response to Education Queensland’s New Technologies Project (March 1999) the Virtual Schooling Service (VSS) was established to develop online services and flexible curriculum delivery options to maximise the educational benefits of Education Queensland’s considerable investment in network infrastructure.

*The VSS aims to exploit this potential to enhance the subject choice available to senior secondary learners via use of an interactive online environment. The students*

*targeted are those in metropolitan, and rural and remote areas who have limited subject choice at their current school due to school size or location.*

*The VSS is building a teaching and learning environment using computer-mediated communication systems that aims to improve access to curriculum and learning experiences by allowing students and teachers to participate in a networked learning community and to improve the quality and effectiveness of education by using the technology to support a collaborative learning process. This learning process emphasises group or cooperative efforts, active participation and interaction on the part of both students and teacher, and new knowledge that emerges from an active dialog among those who are sharing ideas and information. (Turoff, 1995)*

### **Subject provision**

This environment provides for both synchronous and asynchronous group communications and collaborative approaches to learning. The student is an active part of a learning group but is also expected to develop skills of independent learning.

In 2000, the first year of operation, 120 students from 26 schools were registered with the VSS. Year 11 Economics, Japanese, Maths C and Computer Studies were delivered by teachers based at AccessEd. Teachers seconded to the pilot are required to provide online lessons and develop Web-based learning materials for use within the learning platform.

In 2001, the pilot expanded the Year 11 subjects to Year 12 and offered Modern History and Information Processing and Technology (Year 11), and Japanese (Year 9). School-based delivery commenced with three trial schools delivering Maths C, Economics and Japanese to a new Year 11 cohort. In 2001, 300 students from 49 schools, from Thursday Island to Goondiwindi participated in the Service.

In 2002, Physics (Year 11) has been added to the available subjects. An additional two school-based delivery sites have been established to teach Modern History and Information Processing and Technology to a new Year 11 cohort. It is anticipated that 450 students will be registered with the service this year.

### **Real time interaction**

Real time interaction is a key feature of the VSS. Research indicates that such interaction has a significant impact on student learning. The Vicarious Learner Project being conducted jointly by the Glasgow Caledonian University and the University of Edinburgh proposes that dialogue between teachers and students and possibly more importantly between students themselves is essential to effective learning through distance education (McKendree, et al. 1998). Murphy suggests that four types of interaction are necessary to reframe the quality of teaching and learning at a distance: learner-content, learner-teacher, learner-learner and learner-interface. (Trueman, 1995)

The VSS model enhances and expands the traditional 'distance education model' by using audiographic computer technologies which allow for a higher rate of real time interactivity and more immediate feedback than can be achieved through paper based lesson materials sent to the student and supported by 'on air' lessons as well as audio and video resources.

Teachers use a combination of telephone and computer conferencing in an interactive web based environment for their regular timetabled (synchronous) interaction with students at participating schools. At present each class has two lessons with their teacher, each week. Occasionally additional lessons and tutorials are added to the normal routine.

Students also access prepared curriculum resources at a secure Web based location from any networked computer within the school, utilise closed email discussion lists with their fellow students and teacher, or discuss and collaborate on subject activities via “real-time” chat rooms. Teachers can also email materials to students or place them in a virtual subject resource folder.

Shared data applications are among the other features of the service. The software used also has the capacity to compile administrative data and monitor student progress. Information can therefore be provided both to teachers and to the students’ schools on an ‘as needs’ basis.

Students currently have two real time or synchronous lessons per week and communicate with their teacher using telephone (audio) and computer conferencing (text/graphics) in an interactive web based environment. Students are timetabled for three asynchronous lessons per week and they can access on-line lesson materials from a secure location on the web.

Teachers organise additional synchronous lessons and tutorials with students providing further opportunities for students to engage in discussion, reflection, problem solving, sharing, questioning and collaboration.

### **Human factors**

Learning is essentially a social activity and is enhanced when learners feel ‘connected’ to each other. In distance education, attention needs to be paid to the developing sense of community within the group of participants in order for the learning process to be successful. (Palloff & Pratt 1999, p. 29) Along with an increased awareness of the importance of the ‘affective’ aspects of the learning process the VSS sees the human factors as highly significant and aims to develop communities of on-line learners who support and encourage each other to achieve their full potential.

In 2000 students were asked to complete a survey, part of which required them to indicate which features of VSS delivery they felt supported their learning. One aspect identified by many students as being a contributing factor to their success related to the role of the VSS Study Coach. Study coaches are selected from staff in each of the receiving schools to support VSS students in that school by working with them during synchronous lessons, providing them with guidance re time management and study skills and in some cases additional subject area expertise. When necessary study coaches facilitate access to appropriate hardware and software and advocate on the behalf of students and their VSS teachers for access to resources.

Opportunities to participate in collaborative activities such as web quests, inquiry tasks, ‘real time’ chats and discussions build a sense of community amongst learners. Immediacy of feedback provides teachers with the opportunity to scaffold learning experiences, individualise learning to better suit a range of learning styles and respond to diagnostic and formative assessment tasks without the time delay experienced by students undertaking traditional distance education.

## **Online content**

VSS teaching materials are developed by experienced teachers using syllabus documents developed by the Board of Senior Secondary School Studies (BSSSS). Teachers design, develop and deliver the materials, a model different to the traditional distance education model where the actual teachers have little input into the production of learning materials which is accomplished by a team of writers, instructional designers, editors and production officers.

Materials are stored in the 'study room', a secure Web based location that can be accessed by students from any EdNet networked computer in the school or e-mailed to students prior to synchronous lessons.

An electronic whiteboard is used during synchronous lesson times and teachers are able to share control with students and so engage them in a range of authentic learning experiences. The software (Net Meeting) also allows for data sharing between teachers and students. Teachers use a range of software such as, Power Point, Flash and Dreamweaver to develop interactive learning material and opportunities for further training in the use of these programs are provided.

From our experience of virtual schooling, different types of learners as well as different subject areas require different learning materials and teaching strategies. Although these are not inclusive the following examples are indicative of the types of learning materials used in particular subject areas.

LOTE teachers for example use a range of Flash animations, games, simulations and on-line video and audio files. In Economics, students participate in Web quests where they are engaging in online discussions, using 'real time' chat and threaded discussions with other students and 'experts in the field'. NetMeeting whiteboards are used in Maths C to engage students in collaborative problem solving.

## **Evaluation**

In 2000, independent researchers from the Queensland University of Technology reviewed the VSS operations. The study found that:

The selection of teachers for the VSS has been very effective. The teachers have responded admirably in their use of teaching skills and insights in the creation of completely new sets of materials.

Synchronous lessons provide ample opportunity for students to interact with the materials, the teacher and with each other.

The system of delivery has proven to be the most flexible and cost-effective mode given the present state of the telecommunications infrastructure.

Students who enter the VSS program with computer competencies, pre-requisite subject knowledge and skills in self-directed learning are best able to adapt to this form of learning. (Elliott, Lundin, Richardson: 2000)

Analysis of end-of-year results for VSS in 2000 showed that they performed comparably or in some instances higher than in their face-to-face subjects, and when compared with face-to-face peers. Anecdotal data and information obtained from the student/study coach survey indicates a high level of user satisfaction with the service. The increasing number of schools indicating their interest in wanting to be delivery schools for the VSS indicates the growth in awareness and the desire for schools to be involved in a dynamic and innovative approach to education for the 21 century.

The VSS Pilot Project accomplishments have been impressive in terms of testing a new technology-based option for curriculum delivery. The VSS teachers, in particular, have risen to the challenges, worked through a range of difficult and new problems and served the students well through this new model of flexible teaching and learning. Many schools expressed their enthusiasm and encouragement for this initiative, especially those in rural areas. (Elliott, Lundin, Richardson: 2000)

It is totally different from a normal class ... (it) gives you more opportunity to find answers for yourself. (Mathematics C Student)

It gives students opportunities to work in a class environment and get immediate feedback and tuition. It is without doubt the best way to handle distance education. The simple fact that students can ask questions is of immense value. (VSS Study Coach)

### **Impact on networking infrastructure**

Education Queensland has established a statewide network infrastructure, EdNet, which links all of the approximately 1300 state schools. Initially, schools were provided with a 64K or 128K connection to the network (depending on enrolment). Some schools have increased their network connection beyond the initial provision. All VSS delivery schools have been provided with a 256K frame relay connection. Approximately 400 schools are being provided with an ADSL connection to improve bandwidth. The impact of this on VSS delivery is yet to be determined.

The original EdNet infrastructure provided adequate infrastructure for administrative and some educational purposes. The increasing data traffic in schools, much of it precipitated by VSS and other online learning initiatives such as Digital Resource Centre, is placing increasing strain on the existing infrastructure. Within budget constraints, upgrades to EdNet have been put in place in an attempt to keep up with this increasing demand. A procurement process has been put in place (EdNet phase 2) to upgrade or replace the wide area network when the existing contract expires at the end of 2002.

Because of the 'closed' nature of the network, VSS students cannot currently access materials stored in the Study Room from their home computers (or any other non-departmental site). With the implementation of the Education Queensland e-learning portal 'Learning Place', this constraint will be overcome in 2002.

Information Management Branch (IMB) in Education Queensland is responsible for the development and maintenance of EdNet and information technology for the department as a whole. IMB has provided considerable support to the VSS: monitoring network traffic; assisting with purchase of servers and other networking infrastructure; liaison with Telstra; technical advice and troubleshooting; and network infrastructure management.

The impact of VSS delivery on school bandwidth is significant. For example, ideally each student would be allocated a computer for the synchronous lessons to ensure they can have hands-on interaction with the materials the VSS teachers are presenting. Feedback from students indicated this is their desired scenario and satisfaction levels increase when it can be arranged. However, because of the increased demand on the school's EdNet connection and the internal school network when the number of computers online increases, VSS teachers have found that they often need to limit the number of computers online simultaneously. It is also found that as network saturation occurs, students often experience 'drop-outs' from the data conference and need to

rejoin the lesson. Since the voice component is carried by teleconference, they are still able to maintain voice contact with their teacher.

The issue of increasing bandwidth is complex. It is often not just a case of increasing the capacity of the 'pipe' to the school. In a number of instances, the bandwidth to the school has been increased and it has not resulted in any significant improvement in delivery. In other cases, the increase bandwidth has been immediately consumed due to poor management practices in the school (this is particularly so in lunch times where unsupervised 'surfing' is permitted).

Providing increased bandwidth to schools is one of a complex inter-related set of issues. Other factors which must be considered include:

- the organisation of the school's local area network infrastructure;
- compliance of the local area network with organisational standards;
- management practices in place at the school for effective utilisation of networking resources; and
- effective training and professional development for network managers

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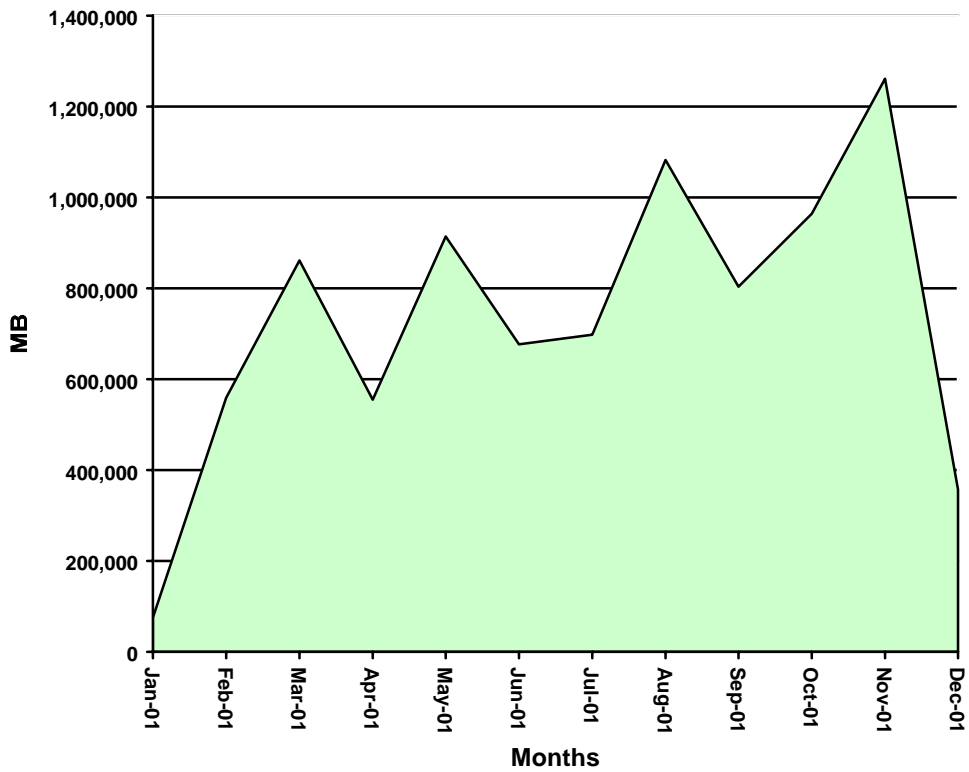
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**INTERNET TRAFFIC**

Jan 01	Feb 01	Mar 01	Apr 01	May 01	Jun 01	Jul 01	Aug 01	Sep 01	Oct 01	Nov 01	Dec 01
75,458	559,212	860,996	554,936	914,180	677,357	697,808	1,082,386	803,662	964,562	1,261,243	357,760

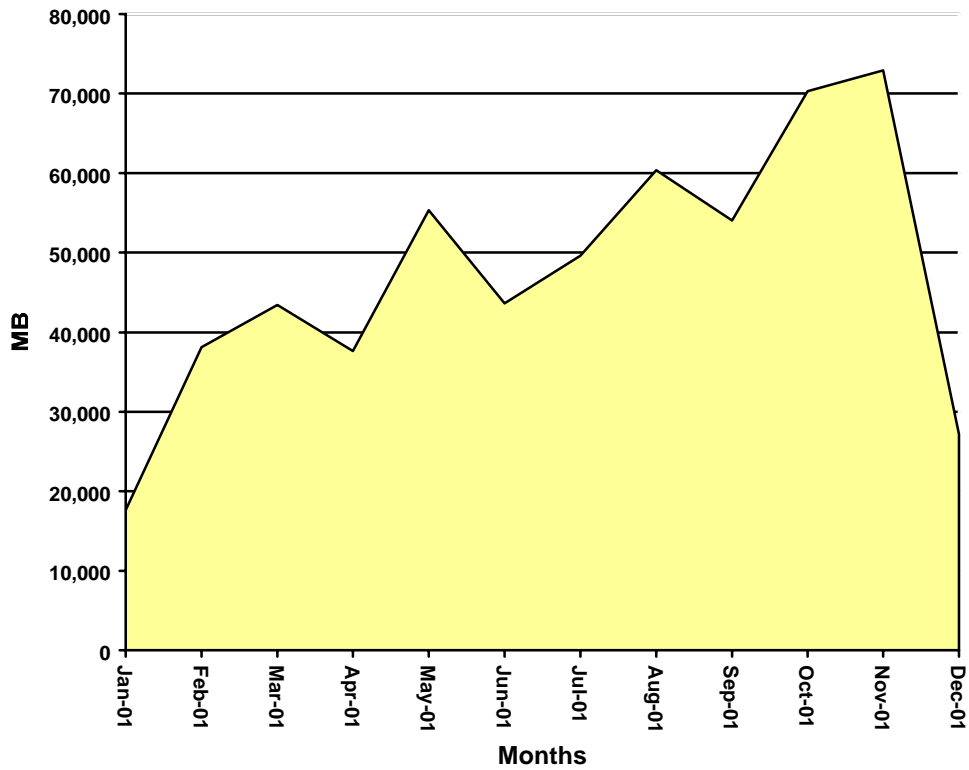
**Internet Traffic**



**MAIL TRAFFIC**

Jan 01	Feb 01	Mar 01	Apr 01	May 01	Jun 01	Jul 01	Aug 01	Sep 01	Oct 01	Nov 01	Dec 01
17,622	38,146	43,416	37,621	55,355	43,597	49,628	60,351	54,068	70,315	72,909	27,167

**E-Mail Traffic**




**MCEETYA ICT IN SCHOOLS TASKFORCE**
**BANDWIDTH SURVEY**
**JURISDICTION:**
**DETE SOUTH AUSTRALIA**
**SECTION A: PROCUREMENT ARRANGEMENTS**

How do your schools connect with each other?

**VIA THE INTERNET USING AN ISP**

via a Wide Area Network directly

**SECTION B DESCRIPTION OF HOW BANDWIDTH IS ARRANGED FOR YOUR SCHOOLS**

B1 What is your standard bandwidth provision to schools? (eg 64 k, 2mg)

- a) **Standard 128K for all schools**
- b) **Schools with more than 675 students have 256K**
- c) **7 sites have 2Mb**
- d) **1 has 1.5 Mb ADSL**
- e) **4 2-way satellite sites**

B2 How do you determine what bandwidth is provided for schools?  
(Please provide details where there is a different level of bandwidth allocation across schools)

- a) and b) in B1 above related to number of students**

B3 What is your provision for rural and remote schools?

- **Same as metropolitan**
- **4 2-way satellite sites where Telstra ISDN not available**

B4 To what extent have you changed your bandwidth provision to schools over the last two years?

**Provision described above began in Term 4, 1999**

B5 What plans do you have to extend connectivity to schools over the next two years.

**Primary focus in next two years will be to improve quality of services with opportunities for schools to expand on demand.**

**We will be taking advantage of the recently announced new state telecommunications agreement with Telstra with wide-band IP.**

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**SECTION C MANAGEMENT ARRANGEMENTS**


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- C1 Describe the tools that schools have to manage connections and traffic.
- **Telstra manages routers**
  - **Traffic managed through SINA Tools**
- C2 What policies that you have in place to manage usage?  
For example, do you control times of internet use?  
**No policies at system level; schools manage usage through SINA Tools.**
- C3 Do schools have to pay for connection and usage costs directly, or is this centrally provided and funded?  
**sa.edu is heavily subsidised at the system level with a component of user pays from schools.**
- C4 What caching arrangements do you have in place at the school level and centrally?
- **School level caching is through web cache servers**
  - **Centrally through access to SchoolsNet cache engines**

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**SECTION D ONLINE LEARNING**


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**NB This question is being addressed in detail by systems in the report to mceetya on progress in implementing *learning in an online world***

- D1 To what extent is Online Learning is occurring over the network?
- **Most online learning is Internet access and email**
  - **The Open Access College is currently the major online deliverer. Courses, eg Year 12 English, Legal Studies and Chemistry, and components of other courses, eg Indonesian, Mathematics, are delivered online to students from Reception to Year 12. A pilot project in 2002, known as SIASOTA (Satellite Internet Access for the School of the Air), involves 20 geographically isolated Year 2 and Year 5 students in an online networked community.**
- D2 What work is your state doing to further the appropriate use of technology in schools?  
**The objective of the South Australian government's new 5-year *e-education* Project is to provide staff and students with access to leading-edge computer technology and relevant training, to ensure students leave school with the computer skills vital for their success.**

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**SECTION E CONTACT OFFICER**


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**MCEETYA ICT IN SCHOOLS TASKFORCE**
**BANDWIDTH SURVEY**
**JURISDICTION:**
**TASMANIA**
**SECTION A: PROCUREMENT ARRANGEMENTS**

How do your schools connect with each other?

VIA THE INTERNET USING AN ISP

via a Wide Area Network directly

**SECTION B DESCRIPTION OF HOW BANDWIDTH IS ARRANGED FOR YOUR SCHOOLS**

B1 What is your standard bandwidth provision to schools? (eg 64 k, 2mg)

- **148 Schools with 64 kb/s ISDN**
- **30 Schools with 128 kb/s ISDN**
- **15 Schools with 256 kb/s ISDN**
- **8 Schools with 512 kb/s ISDN/ADSL**
- **3 Schools with 640 kb/s Frame Relay**
- **3 School with 1.5 Mb/s ADSL3 Schools with I Stations on dial-up connections**

B2 How do you determine what bandwidth is provided for schools?  
(Please provide details where there is a different level of bandwidth allocation across schools)

**Initially schools were provided with 64K. As their bandwidth needs exceeded this figure (as identified on a usage graph) they were given higher bandwidths to a maximum of 256K. Independently all year11-12 colleges were given 512K – 640K services.**

**ADSL lines of between 256/64K to 1.5M/256K have been put into 20 schools on a trial basis.**

B3 What is your provision for rural and remote schools?

**Rural schools are treated the same as urban schools and are provided bandwidth up to 256K on need. ADSL is not available to rural schools.**

**There is one one school to which ISDN services aren't available. As the school has only 6 students, a dial up service is considered sufficient at this stage.**

B4 To what extent have you changed your bandwidth provision to schools over the last two years?  
**2 years ago most schools had 64K services.**

B5 What plans do you have to extend connectivity to schools over the next two years.  
**Over the next 2 years it is expected to provide high bandwidth to over 50% of Tasmanian schools. This higher bandwidth is expected to be in the range of 2M –10M.**

**Effort will also be put into decreasing the need for higher bandwidth through special caches and other network management tools.**

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**SECTION C MANAGEMENT ARRANGEMENTS**

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C1 Describe the tools that schools have to manage connections and traffic.

- **Schools have “Network Traffic Reports” available to them. These show network usage over 15 minute periods for days, weeks months and years. The graphs highlight when the schools is reaching saturation.**
- **Schools have Internet usage reports for the month available.**
- **Most schools have Schoolsnet which allows a range of internet management facilities.**
- **Trials are being conducted with “Packateer” and “Sitara” equipment to identify benefits in traffic management.**
- **A simple Linux program is being used in a number of schools to divide existing bandwidth into student, teacher and admin use.**

C2 What policies that you have in place to manage usage?

For example, do you control times of internet use?

**The management of Internet traffic is done at the school level. Schools have developed their own “acceptable use” guidelines based on a central template. Each school decides what will be and won’t be allowed over the school link.**

**Most schools find tools such as “chat” (directed and limited) good for appropriate learning experiences.**

C3 Do schools have to pay for connection and usage costs directly, or is this centrally provided and funded?

**Currently connections and Internet use are paid for. It is expected that as higher bandwidth services are made available to schools, the situation will change so that a per student allocation of Internet use will be provided to schools. Schools will have to fund excess usage from general funding provided to the school.**

C4 What caching arrangements do you have in place at the school level and

centrally?

**Schools with high bandwidth needs have a cache within the school. There are central caches to further minimise the amount of material that needs to be accessed over the Internet.**

**A project will commence soon to place Online course content servers in schools. This will decrease the bandwidth needs for a range of Online objects.**

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**SECTION D ONLINE LEARNING**

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D1 To what extent is Online Learning is occurring over the network?  
**To a limited extent.**

**The department has WEBCT servers as the basis for a learning management system. This system together with the DISCOVER web system provides a range of Online materials for use in schools.**

**Usage is limited by the lack of bandwidth to schools.**

D2 What work is your state doing to further the appropriate use of technology in schools?

**The Department has put together a Centre of Excellence in Online Learning called e-magine. This group has a range of tasks including online material development, teacher professional development, encouraging the uptake of online learning and investigation of technologies to deliver online learning.**

**As part of e-magine, there are a number of courses being delivered to students over the network. This is assisting in schools with few students wishing to take a subject, where there isn't a skilled teacher in the subject at the school or for a number of other reasons, but is also starting to embed online learning as an integral part of school/ college teaching and learning programs. These courses form part of the Discover Online School, which commenced operation during 2001 and involves 65 Tasmanian Government schools and colleges. .**

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**SECTION F CASE STUDY**

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Two pieces of information that are of note.

- If seasonal variations (due to schools on holidays) is excluded, the monthly use of Internet within the Tasmanian school system has remained reasonably static over the past 6 months of between 400 – 500 Gigabytes.
- A study was conducted on the extent to which schools were using the bandwidth that had been allocated to them. This was provide some indication of whether current bandwidths were sufficient. The study was to look at the graph of activity for each school for a week long period. The graph showed that:
  - 8% of schools were grossly under-utilizing bandwidth available to them. (for many of these schools this was an abnormal week)
  - 34% of schools had a reasonable bandwidth for the use they were making
  - 34% of schools needed higher bandwidth. A number of times each day the system would be very slow.
  - 21% of schools badly needed higher bandwidth. For most of the days there was no period where bandwidth wasn't being fully utilised which means that it would appear slow at all times.
  - 3% of schools were a stage worse than “badly needing higher bandwidth”. It is likely that these schools would be unable to use the bandwidth because of the serious contention issues.


**MCEETYA ICT IN SCHOOLS TASKFORCE**
**BANDWIDTH SURVEY**
**JURISDICTION:**
**VICTORIA**
**SECTION A: PROCUREMENT ARRANGEMENTS**

How do your schools connect with each other?

VIA THE INTERNET USING AN ISP

via a Wide Area Network directly

**SECTION B DESCRIPTION OF HOW BANDWIDTH IS ARRANGED FOR YOUR SCHOOLS**

- B1 What is your standard bandwidth provision to schools? (eg 64 k, 2mg)  
**64Kbps per campus is the standard bandwidth provisioning. An additional 64Kbps is provided for schools with enrolments over 500 pupils, and an additional 128Kbps is provided for schools with enrolments over 1500 pupils. The centralised funding of the additional bandwidth is currently being reviewed.**
- B2 How do you determine what bandwidth is provided for schools?  
 (Please provide details where there is a different level of bandwidth allocation across schools)  
**The initial provision of centrally funded bandwidth was purely a financial decision, to ensure all schools received a minimum VPN (Virtual Private Network) connection. Today, schools are encouraged to self-fund bandwidth that satisfies the Department's computer to bandwidth ratio guide line. The guideline recommends 64Kbps of bandwidth be provided for each 64 network connected devices. The guideline is based upon contention usage.**
- B3 What is your provision for rural and remote schools?  
**All schools, including regional and country have been provided with standard bandwidth provision as stated above. Even though some remote schools may utilise a two-way satellite service, bandwidth size is the same as other schools to ensure equity.**
- Bandwidth upgrade costs for outer metropolitan, regional and country are subsidised by the Department to provide equity compared to inner metropolitan tariffs.**

B4 To what extent have you changed your bandwidth provision to schools over the last two years?

Please see table below.

Connection Type	Year	Per cent	Year	Per Cent
ISDN (192 - 2048Kbps)	2000	3%	2001	3%
ISDN (128Kbps)	2000	17%	2001	17%
ISDN (64Kbps)	2000	75%	2001	76%
Radio (512 – 2048Kbps)	2000	1%	2001	1%
Radio (64Kbps)	2000	3%	2001	2%
Satellite (64Kbps)	2000	1%	2001	1%

B5 What plans do you have to extend connectivity to schools over the next two years.

**The re-tender of the State Government's data, video and voice telecommunications provider/s is expected to commence in September 2002. Future provision of bandwidth will depend on tariffs and services provided by the successful tender/s, and available budget.**

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#### SECTION C MANAGEMENT ARRANGEMENTS

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C1 Describe the tools that schools have to manage connections and traffic.  
**Schools have access to a Web based tool that provides statistical graphs of bandwidth utilisation over user defined periods of time.**

**In addition, schools are self-purchasing bandwidth management devices that have been evaluated by the Department, to provide bandwidth control and reporting.**

C2 What policies that you have in place to manage usage?  
For example, do you control times of internet use?  
**Victorian schools operate under a self-managing model, therefore schools are responsible for managing their own usage.**

**The Department has provided schools with duty of care guidelines for Internet and email usage.**

C3 Do schools have to pay for connection and usage costs directly, or is this centrally provided and funded funded?  
**Victorian schools are responsible for self-funding any bandwidth above the standard provision (Department has provided a level of subsidisation**

**in the past), and Internet Service Provider subscription fees and content usage.**

- C4 What caching arrangements do you have in place at the school level and centrally?  
**Schools have been provided with a centrally funded proxy server running MS Proxy 2. Due to technology advancements, schools are being encouraged to self-fund new generation caching appliances.**

**Technical evaluations performed by the Department have proven that new generation caching appliances are six (6) fold more efficient than traditional caches.**

**All VPN connected ISPs have some level of caching. Some ISPs have a tiered caching arrangement, therefore providing different levels of cached content at different download costs.**

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**SECTION D ONLINE LEARNING**

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- D1 To what extent is Online Learning occurring over the network?  
**See separate report titled Learning in an On-Line World.**
- D2 What work is your state doing to further the appropriate use of technology in schools?  
**As above.**

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**SECTION E CONTACT OFFICER**

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**SECTION F CASE STUDY**

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**The Department has engaged the VPN provider AAPT to provide a detailed statistical analysis of bandwidth use by Victorian schools. These preliminary results are expected within the next 4 – 6 weeks.**


**MCEETYA ICT IN SCHOOLS TASKFORCE**
**BANDWIDTH SURVEY**
**JURISDICTION:**
**WESTERN AUSTRALIA**
**SECTION A: PROCUREMENT ARRANGEMENTS**

How do your schools connect with each other?

**VIA THE INTERNET USING AN ISP**

via a Wide Area Network directly

**SECTION B DESCRIPTION OF HOW BANDWIDTH IS ARRANGED FOR YOUR SCHOOLS**

- B1 What is your standard bandwidth provision to schools? (eg 64 k, 2mg)  
**The current bandwidth is 64K dial on demand for a majority the remainder use PSTN dial on demand, with some very remote schools not being connected.**
- B2 How do you determine what bandwidth is provided for schools?  
 (Please provide details where there is a different level of bandwidth allocation across schools)  
**The current bandwidth was determined based on affordability. The most recent contract was based on recommendations from various research which determined that a minimum of 256Kb per school was required to deliver acceptable some level of content. This Department established a cost estimate based on standard pricing and when the contract was evaluated the original price estimate was used to determine the bandwidth.**
- B3 What is your provision for rural and remote schools?  
**Currently the same as metro 64K dial on demand. Under our new contract, the price determines the bandwidth. The price for 10Mb in metro is equivalent to 512K in regional. Extra funding was sought to increase regional bandwidth to high schools to 2Mb**
- B4 To what extent have you changed your bandwidth provision to schools over the last two years?  
**No change**

B5 What plans do you have to extend connectivity to schools over the next two years.

**The Department has commenced rolling out the following bandwidth: -**

- **10Mb/s to every metro school**
- **2Mb/s to every regional high school**
- **512Kb/s to every regional primary school**
- **2 way satellite (5.9Mb/s inbound shared and 3x128K outbound shared to 39 remote schools**

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**SECTION C MANAGEMENT ARRANGEMENTS**

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C1 Describe the tools that schools have to manage connections and traffic.  
**None.(this is to change as part of the telecommunications project)**

C2 What policies that you have in place to manage usage?  
For example, do you control times of internet use?  
**Schools currently determine policy therefore varies from school to school (this is to change as part of the telecommunications project)**

C3 Do schools have to pay for connection and usage costs directly, or is this centrally provided and funded?  
**Currently schools pay. A centralised service is being established as part of the telco project**

C4 What caching arrangements do you have in place at the school level and centrally?  
**Caching at the school is an issue for the school. Again, the telecommunications project will bring that into a centrally managed and remotely distributed service.**

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**SECTION D ONLINE LEARNING**

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D1 To what extent is Online Learning is occurring over the network?  
**None**

D2 What work is your state doing to further the appropriate use of technology in schools?  
**The Education to Community strategy has been developed to deliver Online learning. The strategies first goal is to procure the appropriate infrastructure to support the use of technology. These procurement processes have commenced.**

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**SECTION E CONTACT OFFICER**

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## **TOWARDS A PEDAGOGICAL APPROACH TO CALCULATING BANDWIDTH NEEDS FOR SCHOOLS 2002-2003**

This paper attempts to forecast bandwidth needs to meet the emerging pedagogical needs for schools in the early stages of implementation of online learning in 2002.

It should be noted that this is a generalization, informed by education leaders from the Centre of Excellence and underpinned by a number of assumptions. The paper is intended to generate debate on the need to move from a provision of 64 – 256k to a broadband bandwidth provision for the school education sector.

The assumptions are articulated (*in italics*) so that the model can be scaled to match the implementation levels of systems and schools within systems.

### **Bandwidth Provision**

1. *There is guaranteed bandwidth performance level at the school:  
Email and general systems need to work effectively for administrative staff  
Teachers need to be certain that there will be sufficient bandwidth for online delivery in their teaching and learning programs.  
Students need to be convinced that they will have access to reliable and time efficient infrastructure to search for and download materials.*

This assumption is key to the successful delivery online learning. It is unlikely that teachers and students will embrace technology if online learning lessons are aborted due to slow bandwidth response.

To meet this assumption, the normal practice of calculating bandwidth needs and using a divisor factor (often 4) to account for the adhoc multi-user nature of bandwidth will not be applied in a school setting.

### **Bandwidth Needs in a school.**

2. *For typical classroom and administrative activities such as internet browsing, email, chat and access to corporate systems through the use of Terminal Servers, the bandwidth requirements are between 10 – 15K. For this exercise 10K will be used.*
3. *For Tasmanian Online courses that are being developed the bandwidth is limited to 33K. However this limitation isn't in place overseas where Online course objects need bandwidth in the order of 128K. For this exercise a compromise number of 64K will be used.*
4. *Typically there are 6 computers in a classroom(ratio 1:5). These computers are used 80% of the time, with 50% of that time being bandwidth usage.*
5. *Specialist computer labs have a different usage profile. Computers need to access bandwidth at the same time especially at the beginning of the lesson and therefore the figure of 80% usage can't be applied, the figure needs to be 100%, with bandwidth accessed 50% of the time.*

### **Videoconferencing and Data streaming.**

6. *The capacity needed for both videoconferencing and video streaming is similar. Standard videoconferencing set-ups operate at between 128K and 384K. The figure use in calculations will be 256K.*

It is possible to decrease the bandwidth requirements by decreasing the size of the picture making 64K a usable bandwidth, this is not the preferred pixel density for effective videoconferencing.

### **Management of Bandwidth.**

7. *There are a number of tools available to assist in the better utilization of bandwidth. Caching through proxy servers and special information stores located within schools helps decrease bandwidth needs. Products such as "Packateer" which prioritise traffic on lines helps improve the utilization of existing bandwidth.*

Despite the value of these products, they won't be factored into these calculations. It should be remembered that bandwidth can be decreased through the use of these tools.

### **Calculation for a Schools of 400 students.**

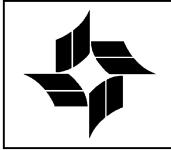
*In calculating the desired bandwidth it is assumed Online learning is an active part of the school curriculum. This is not currently the case in most Tasmanian schools*

- *.There are 50 PCs for student use (ratio of 1:8)*
- *The mix of use of this equipment will be equal between general use and online courses outlined in Assumptions 2 and 3.*
- *There are 2 labs of computers (30 in each)*
- *There are 3 concurrent videoconferencing sessions.*
- *The admin use of bandwidth is 64K*

	Calculations	Bandwidth
General School Use	25 PCs x 10K x .8 x .5	100K
Online Courses	25 PCs x 64K x .8 x .5	640K
Labs	60 PCs x 64K x .5	1920K
Video links	3 x 256K	768K
Admin Use		64K
	<b>TOTAL</b>	<b>3,492K</b>

Dividing the total by the number of students a figure of  $3492/400 = 8.7\text{K}$  per student

Max Gentle  
24<sup>th</sup> January 2002

**MCEETYA ICT IN SCHOOLS TASKFORCE MEETING****WEDNESDAY 28 NOVEMBER 2001****BANDWIDTH FORUM REPORT AND FUTURE ACTIONS****AGENDA ITEM 4.2**

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**PURPOSE**

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- To provide the ICT in Schools Taskforce with information on bandwidth issues in the school sector.
- To raise issues for discussion at the November meeting.

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**BACKGROUND**

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- A national bandwidth forum attended by states/territories/jurisdictions, DETYA, *education.au limited* and [Le@rning](#) Federation was held in Sydney on September 26 and 27. A copy of the agenda and a list of participants is included as attachments to the report.
- The forum identified bandwidth issues and suggested bandwidth targets for the school sector.
- Peter Croger, consultant to the project, will lead discussions at the meeting.

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**ISSUES**

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- The telecommunications needs of schools are growing exponentially. The emerging nature of the demands of the online learning has resulted in a lack of clarity regarding benchmark targets.
- The development and promulgation of benchmark targets has to some extent been hampered by a lack of information on current and emerging telecommunications usage by schools.
- Many of the issues need to be addressed within individual states and territories. Nevertheless, within the bounds of the various whole of government telecommunications arrangements operating in states and territories, there are opportunities for further co-operation.
- There appear significant opportunities to address the needs of remote Australia through satellite or other technology. The National Communications Fund offers an immediate funding opportunity but the time to prepare and secure agreement for an application is short. Applications must be submitted by 28 February 2002.

- As technology is developed, the issues concerning telecommunications infrastructure increasingly overlaps with other infrastructure including local school networks and computers.
- Telecommunications issues are related to the cost of data carriage, traffic content and technical management
- The overriding issue constraining access to adequate telecommunications services remains the market structure and regulatory regime. As the Commonwealth Government addresses telecommunications issues, it is critically important that the needs of school education are clearly articulated.

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**RECOMMENDATION/S**


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1. That the following benchmark bandwidth targets for 2003 be endorsed for the Australian school education sector:

<b>Year</b>	<b>Bandwidth per Student</b>	<b>Small School (200 Students)</b>	<b>Large School (1000 Students)</b>
2003	10 kbps	2 mbps	10 mbps
2006	100 kbps	20 mbps	100 mbps

The target for 2006 is based on an exponential increase in demand related to the online learning.

2. That a working group of the task force undertake an ongoing program to monitor emerging bandwidth needs and costs by:
  - a. Monitoring the emerging system and school needs based on the adoption of the online learning paradigm is adopted in schools;
  - b. In conjunction with other task force working groups, identifying the key software applications being adopted by Australian schools and highlighting the telecommunications implications of these applications;
  - c. Pooling statistics on telecommunications usage from schools systems including volume and type of traffic to produce national summaries. Distinctions would be made between “leading” users of ICT and “average” users of ICT;
  - d. Within the bounds of commercial restrictions, pooling broad information on telecommunications expenditure by school systems to identify the per student costs under the headings of data carriage, traffic content and technical management;
  - e. Reporting back to the task force in early 2002 and thereafter, at least annually.

3. That a multi-state/territory application be prepared to the National Communications Fund to meet the telecommunications needs of remote Australia according to the following process:
  - a. Participating states/territories to confirm their support within two weeks;
  - b. A working group be convened as a matter of urgency to prepare a funding application;
  - c. A consultant with expertise in remote telecommunications solutions and costs be engaged to assist the working group;
  - d. A draft funding application be prepared by 15 February 2002 for endorsement by participating states/territories.
4. That in early 2002 and following finalisation of the Learning Federation exchange architecture, a focused meeting examine possibilities for sharing the purchasing and caching of Internet content as a means of reducing Internet traffic costs by individual school systems.
5. That in mid to late 2002, a broader follow up workshop be held including technical managers from school systems to address issues and opportunities for technical infrastructure. The focus would include both telecommunications infrastructure and school level infrastructure including local networks and computers.
6. That a report be provided to Ministers including:
  - a. Current and emerging benchmarks;
  - b. Current and emerging costs;
  - c. Co-operative activities.